

SOUTHERN FOREST EXPERIMENT STATION

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EARLY SURVIVAL OF COTTONWOOD AND
HYBRID POPLAR PLANTATIONS AT STONEVILLE, MISS.

By

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and
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Southern Forest Experiment Station

In cooperation with
DELTA EXPERIMENT STATION, Stoneville, Miss.

The major portion of this study was carried on in cooperation with the Mississippi Agricultural Experiment Station under the Cooperative Farm Forestry Act of 1937.

The Occasional Papers of the Southern Forest Experiment Station present information on current southern forestry problems under investigation at the Station. In some cases, these contributions were first presented as addresses to a limited group of people, and as "occasional papers" they can reach a much wider audience. In other cases, they are summaries of investigations prepared especially to give a report of the progress made in a particular field of research. In any case, the statements herein contained should be considered subject to correction or modification as further data are obtained.

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Experimental plantations of native cottonwood cuttings and seedlings, and of 10 varieties of hybrid poplar cuttings, were established between January 30 and April 26, 1940, at the Delta Experiment Station, Stoneville, Miss. The plantations were examined June 18 - 21, 1940, to determine the early survival, and this paper is a report on the findings. The study is a part of a cooperative forest research program of the Southern Forest Experiment Station and the Mississippi Agricultural Experiment Station.

Established on forest land that before planting supported only a scanty stand of mixed hardwoods (not including cottonwood) and cypress, mostly culls or of low grade, the plantations are for the purpose of investigating and comparing different methods of reforesting such land with fast-growing trees that will yield merchantable pulpwood, or later sawlogs, in the shortest possible time. There have been few previous studies of forest planting in the Delta; hence there was little background of experience for the present study. Valuable advice was obtained, however, from Mr. R. D. Stevens, of the Department of Horticulture and Forestry, University of Arkansas, who had recently made experimental cottonwood plantings in the Delta region of Arkansas.

Planting Sites

One experimental plantation (designated D-2) occupies a well-drained "flat" that supported bottomland red oak, overcup oak, water hickory (bitter pecan), American elm, and other bottomland species. The other plantation (designated D-5) is divided by a shallow slough into a "ridge" and a shallow swamp. The ridge site is definitely higher than the site of the D-2 plantation, and once supported such species as redgum^{1/} and water oak. The swamp supported cypress, waterlocust, swamp privet,^{2/} and other swamp species, and was partially under water throughout the planting period. The D-2 site is too wet in the spring for profitable agricultural use except in unusually dry years. The D-5 ridge site is fair to good farm land, but the area is small and relatively inaccessible. The D-5 swamp site is entirely unfit for farming, even though there is a large drainage canal within a quarter-mile.

^{1/} The common name recently accepted by the Forest Service for Liquidambar styraciflua is sweetgum.

^{2/} Similarly, Forestiera acuminata is common adelia.

To provide more uniform conditions for experimental purposes, and to facilitate the planting and later examinations, the largely low-grade and cull trees on the D-2 site were girdled, and the sparse stand of similar trees on the D-5 sites was clear cut. On D-2 the planting was done in narrow lanes cut through the dense brush, weeds, and vines with "Kaiser" blades. On D-5 the entire planting area was cleared with Kaiser blades after the trees were removed. The brush, weeds, and vines sprouted vigorously in the spring and were 2 to 5 feet high in mid-June.

Planting Stock and Methods

Ten varieties of hybrid poplar cuttings were obtained from the Northeastern Forest Experiment Station, a branch of the U. S. Forest Service located at New Haven, Connecticut. These varieties were selected from among hundreds bred by that station as especially desirable for reforestation in the Northeast. Their growth and value in the Delta are problematical.

Cuttings from native cottonwood (Populus deltoides virginiana) were taken with pruning shears from vigorous shoots in the upper portions of freshly felled trees in stands between the levee and the Mississippi River near Greenville, Miss. The trees were mostly 2 to 8 inches in diameter, although a few were as large as 12 inches in diameter. "Fresh" cuttings were planted within 2 to 4 days of their preparation, being heeled into the ground or stored in shallow water in the meantime. "Stored" cuttings were kept in cold storage at a temperature of about 35° F. between the time of preparation (March 4) and that of planting. Four different lengths of cutting, two depths of planting for each length of cutting, and three dates of planting were tested with fresh cuttings. A single length of cutting and depth of planting at three different planting dates were tested with stored cuttings.

On site D-2 hybrid poplar cuttings and fresh cottonwood cuttings were planted at a time (January 30 - February 2) when cottonwood buds were completely dormant. On site D-5 cottonwood cuttings and seedlings only were planted. These plantings included one while the cottonwood buds were still dormant (March 6 - 8 and 11), one at the time the buds were beginning to open (March 25 - 27), and two after the buds had opened in the woods (April 15 - 17 and April 26). All cuttings were set in holes made by cylindrical planting bars. Bars of various diameters from 1/4 to 7/8 inch were used, depending on the diameters of the cuttings. An effort was made to obtain a tight fit for each cutting, and contact between the base of each cutting and the bottom of the hole.

Cottonwood seedlings were obtained from nearby ditches and borrow pits for experiment D-2, and from stands between the levee and the Mississippi River for D-5. Seedlings 1½ to 7 feet high and mostly 2 years old were selected and pulled up without any digging. The seedlings were then planted, after just enough trimming of the roots to permit planting in holes made by the same planting bars used for the cuttings. The tops of some seedlings were left unpruned, whereas others were cut back to 2, 4, or 18 - 24 inches. Both fresh and stored seedlings were planted, the former at the same dates as the cuttings, but the latter only at the last date.

Early Survival

For each test the number planted, the number "alive" (i.e., with green leaves) on June 18 - 21, 1940, and the percentage alive, are recorded in tables 1 and 2. These results are reported now because of the widespread interest in the tests and because of the large differences already in evidence. No detailed statistical analysis will be made until the survival for the complete growing season has been recorded, but inspection of the tables shows a number of interesting and probably significant results already obtained. An important point to note here is that the results have undoubtedly been affected to some extent by the unusually cold, wet spring weather experienced at Stoneville. Conditions suitable for growth were estimated to have occurred about 3 weeks later than usual.

The hybrid poplar cuttings exhibit a wide range of survival, from 36 to 97 percent. Four of the ten varieties show more than 85 percent survival, three show between 50 and 85 percent, and three show less than 50 percent. No other comment on the hybrid poplar cuttings seems necessary at this time.

A tabulation of the more successful planting tests in which native cottonwood cuttings and seedlings were used is given in table 3. The most outstanding results obtained with cottonwood planting stock may be summarized as follows:

1. Seedlings vs. cuttings. In general, seedlings showed higher survival than cuttings. The best survival among the seedlings was about 85 percent, compared with about 60 percent for the best cuttings.

2. Cutting back of seedlings vs. no cutting back. Seedlings that were cut back immediately after planting showed higher survival than seedlings not cut back. The survival of fresh seedlings planted during dormancy and cut back to various lengths up to 24 inches was 80 to 88 percent, whereas the survival of fresh dormant seedlings not cut back was 46 to 68 percent. The survival of stored dormant seedlings planted about one month after cottonwood buds opened in the woods, and cut back to various lengths up to 24 inches, was 69 to 100 percent, whereas the survival of stored dormant seedlings not cut back was lower by 12 to 28 percent.

3. Terminal vs. nonterminal cuttings. The survival of fresh dormant cuttings was not appreciably or consistently affected by the presence or absence of terminal buds on the cuttings.

4. Early vs. late planting during the dormant period. Planting 3 weeks and 8 weeks before cottonwood buds opened in the woods resulted in approximately the same survival.

5. Planting during dormancy vs. planting after growth started. Fresh cuttings and seedlings showed higher survival when planted during the dormant period than when planted after growth had started. The average survival of all fresh cuttings planted during the dormant period was 31 percent better (range, 6 to 57 percent better) than the average survival of all fresh cuttings planted 2 to 3 weeks after cottonwood buds opened in the woods. Fresh seedlings averaged 62 percent better survival (range, 38 to 80 percent better) at the earlier date.

6. Early vs. late planting of stored cuttings after growth started. The survival of stored cuttings was equally good at 2 to 3 weeks and at 4 weeks after cottonwood buds opened in the woods.

7. Stored vs. fresh cuttings, planted after the dormant period. Stored dormant cuttings showed higher survival than fresh cuttings when planted after the dormant period. Stored dormant 20-inch cuttings planted 16 inches deep showed 6 to 18 percent better survival when planted at the time cottonwood buds opened in the woods, and 46 to 52 percent better survival when planted 2 to 3 weeks after the buds opened, than fresh cuttings of the same specifications.

8. Date of planting in relation to exposed length of stock. The later the date of planting (except for stored material), the greater was the disadvantage of having a large proportion of the length of the planting stock above the ground.

9. Site in relation to date of planting. The effect of site on the survival of seedlings depended on the date of planting. On the ridge, fresh seedlings planted early showed better survival than stored seedlings planted late. In the swamp, however, stored seedlings planted late showed better survival than fresh seedlings planted early. These differences probably are due to the adverse effect of the ridge becoming dryer, and the beneficial effect of the swamp becoming dryer, as the season advanced. Fresh cuttings showed no consistent differences in survival between the ridge and the swamp at the earlier plantings, but higher survival in the swamp at the later plantings.

10. Length and depth of planting of the best cuttings in relation to site. Twenty-inch cuttings generally showed higher survival than shorter or longer cuttings, and the effect of depth of planting depended on the site. In the swamp better survival usually was obtained with relatively shallow planting, whereas on the ridge, relatively deep planting generally was better.

Conclusions

Present indications are that seedlings make the best cottonwood planting stock, that they should be obtained and planted before the buds open in the spring (or obtained at that time and held in cold storage if the planting is to be done after growth has started), and that they should be cut back to 24 inches or less immediately following planting. If fresh seedlings are used, ridges may be planted at any time before cottonwood buds open in the woods, but swamps should be planted as late in the dormant period as possible. If stored seedlings are used, ridges should be planted soon after growth starts in the woods, and swamps should be planted later when the water table is much lower. A more complete analysis and report will be made following the survival examination in the fall of 1940, at the end of the first complete growing season.

Table 1.—Experiment D-2: Summary of survival on June 18 - 21, 1940
of plantings made January 30 - February 2, 1940

Site: flat

Species and class of stock	Length of cutting	Depth of planting	Total	
			Planted	Alive
	- - <u>Inches</u> - -		<u>Number</u>	<u>Percent</u>
<u>Hybrid poplar cuttings</u>				
(Nonterminal ^{1/})				
Oxford Paper Co. No. 6 (P. nigra x P. laurifolia)	12	9	87	60
Oxford Paper Co. No. 14 (P. charkowiensis x P. balsamifera virginiana)	12	9	87	71
Oxford Paper Co. No. 21 (P. charkowiensis x P. caudina)	12	9	87	66
Oxford Paper Co. No. 29 (P. charkowiensis x P. trichocarpa)	12	9	88	91
Oxford Paper Co. No. 33 (P. angulata x P. berolinensis)	12	9	88	45
Oxford Paper Co. No. 39 (P. petrowskyana x P. caudina)	12	9	88	86
Oxford Paper Co. No. 42 (P. maximowiczii x P. trichocarpa)	12	9	88	89
Oxford Paper Co. No. 48 (P. maximowiczii x P. berolinensis)	12	9	87	36
Oxford Paper Co. No. 53 (P. maximowiczii x P. caudina)	12	9	88	49
Oxford Paper Co. No. 55 (P. tacamahacca clon candicans x P. berolinensis)	12	9	88	97
<u>Fresh cottonwood cuttings</u>				
Terminal cuttings ^{1/}	12	9	44	57
Nonterminal cuttings	12	9	44	45
Terminal cuttings	16	12	43	51
Nonterminal cuttings	16	12	44	50
Terminal cuttings	20	15	43	47
Nonterminal cuttings	20	15	43	53
<u>Fresh cottonwood seedlings</u>				
Cut back to 2-inch stem			44	84
Not cut back			44	68

^{1/} A terminal cutting is one made from the end of a shoot, including the last or terminal bud.

Table 2.—Experiment D-5: Summary of survival on June 18 - '21, 1940 of cottonwood plantings
made March 6 - April 26, 1940

Class of stock	Length of cutting	Depth of planting	Site	Date of planting							
				March 6 - 8		March 25 - 27		April 15 - 17		April 26	
				planted	alive	planted	alive	planted	alive	planted	alive
	- - - Inches - - -			No.	Percent	No.	Percent	No.	Percent		
<u>Fresh cuttings</u>	10	6	Ridge	100	17	99	18	100	3		
	10	6	Swamp	97	28	99	35	98	19		
	10	8	Ridge	100	35	100	44	100	0		
	10	8	Swamp	83	30	89	42	83	4		
	20	12	Ridge	99	54	100	36	100	6		
	20	12	Swamp	99	55	100	35	100	3		
	20	16	Ridge	100	64	100	53	100	7		
	20	16	Swamp	97	26	100	29	98	3		
	40	15	Ridge	100	33	100	17	100	1		
	40	15	Swamp	99	37	99	30	100	6		
	40	20	Ridge	100	53	100	27	100	1		
	40	20	Swamp	100	36	100	23	100	15		
	60	18	Ridge	50	24	50	10	50	2		
	60	18	Swamp	50	40	50	14	50	6		
	60	24	Ridge	50	32	50	16	49	4		
	60	24	Swamp	50	38	49	8	50	32		
<u>Stored cuttings</u>	20	16	Ridge			100	71	100	53	<u>No.</u>	<u>Percent</u>
	20	16	Swamp			98	35	100	55	100	53
										100	54
	Top cut back to			<u>March 11</u>							
<u>Fresh seedlings</u>	4	--	Ridge	25	88	12	92	12	8		
	4	--	Swamp	25	80	11	73	12	25		
	18 - 24	--	Ridge	25	80	13	69	13	15		
	18 - 24	--	Swamp	25	88	13	85	13	15		
	Not cut back	--	Ridge	50	64	25	88	25	4		
	Not cut back	--	Swamp	50	46	25	52	25	8		
<u>Stored seedlings</u>	4	--	Ridge							12	83
	4	--	Swamp							12	92
	18 - 24	--	Ridge							13	69
	18 - 24	--	Swamp							13	100
	Not cut back	--	Ridge							25	48
	Not cut back	--	Swamp							25	84

Table 3.—Cottonwood planting stock with at least 25% survival, both plantations

Site	Planting date							
	March 6 -- 8		March 25 -- 27		April 15 -- 17		April 26	
	Kind of stock ^{1/}	Survival	Kind of stock ^{1/}	Survival	Kind of stock ^{1/}	Survival	Kind of stock ^{1/}	Survival
		Percent		Percent		Percent		Percent
<u>Ridge</u>	Fresh sdlgs. 4"	88	Fresh sdlgs. 4"	92	Stored ctgs. 20-16"	53	Stored sdlgs. 4"	83
(D-5)	Fresh sdlgs. 20"	80	Fresh sdlgs. Uncut	88			Stored sdlgs. 20"	69
	Fresh sdlgs. Uncut	64	Stored ctgs. 20-16"	71			Stored ctgs. 20-16"	53
	Fresh ctgs. 20-16"	64	Fresh sdlgs. 20"	69			Stored sdlgs. Uncut	48
	Fresh ctgs. 20-12"	54	Fresh ctgs. 20-16"	53				
	Fresh ctgs. 40-20"	53	Fresh ctgs. 10-8"	44				
	Fresh ctgs. 10-8"	35	Fresh ctgs. 20-12"	36				
	Fresh ctgs. 40-15"	33	Fresh ctgs. 40-20"	27				
	Fresh ctgs. 60-24"	32						
<u>Swamp</u>	Fresh sdlgs. 20"	88	Fresh sdlgs. 20"	85	Stored ctgs. 20-16"	55	Stored sdlgs. 20"	100
(D-5)	Fresh sdlgs. 4"	80	Fresh sdlgs. 4"	73	Fresh ctgs. 60-24"	32	Stored sdlgs. 4"	92
	Fresh ctgs. 20-12"	55	Fresh sdlgs. Uncut	52	Fresh sdlgs. 4"	25	Stored sdlgs. Uncut	84
	Fresh sdlgs. Uncut	46	Fresh ctgs. 10-8"	42			Stored ctgs. 20-16"	54
	Fresh ctgs. 60-18"	40	Stored ctgs. 20-16"	35				
	Fresh ctgs. 60-24"	38	Fresh ctgs. 10-6"	35				
	Fresh ctgs. 40-15"	37	Fresh ctgs. 20-12"	35				
	Fresh ctgs. 40-20"	36	Fresh ctgs. 40-15"	30				
	Fresh ctgs. 10-8"	30	Fresh ctgs. 20-6"	29				
	Fresh ctgs. 10-6"	28						
	Fresh ctgs. 20-16"	26						
<u>January 30 -- February 2</u>								
<u>Flat</u>	Fresh sdlgs. 2"	84						
(D-2)	Fresh sdlgs. Uncut	68						
	Fresh ctgs. 12-9"	51						
	Fresh ctgs. 16-12"	51						
	Fresh ctgs. 20-15"	50						

^{1/} The figures following "sdlgs" (seedlings) represent the height in inches to which they were cut back after planting. The figures following "ctgs" (cuttings) represent the length and the depth of planting, respectively, each in inches.